

PHS
NO. 1186
1964

THIS ITEM DOES NOT
CIRCULATE

FOOD-BORNE DISEASE INVESTIGATION: ANALYSIS OF FIELD DATA

A SELF-INSTRUCTIONAL LESSON

SPECIFICATIONS

Training Objectives

After taking this lesson, the student will be able to:

1. specify the ways in which *Salmonella* and *Staphylococcus* organisms contaminate food and affect humans, and the conditions favorable to their growth and spread;
2. construct an Attack Rate Table, using a Case Histories and Summary Table;
3. identify the infective food in a food-borne disease epidemic, using an Attack Rate Table;
4. determine the time of consumption of the infective food; and
5. apply basic techniques for determining the source of outbreak in a typical food-borne disease epidemic.

Primary Trainee Population

Sanitarians

Secondary Trainee Population

Public Health nurses, physicians, and related health personnel

Individualization Provided

1. There is no time limit; each student may proceed through the lesson at his own rate of speed.
2. Brief remedial instruction on the "median" is provided for those who need it.
3. Although this lesson has been designed for intensive study by "beginning" students, it can be used very effectively for review by more advanced students. For review only, study the "demonstration" pages and skip "practice" pages (these pages will be obvious to you).
4. The lesson can be used to best advantage during times most convenient to the student.

Approximate Learning Time

Experience has shown that this lesson requires from 1½ to 2½ hours actual study time (no time limit implied).

Restrictions and Limitations

1. Students should be able to compute percentages and read and construct simple graphs (histograms) and determine medians. As a refresher, remedial exercises are provided.
2. Students should have general and elementary familiarity with such concepts as bacterial growth, epidemics, sanitation procedures, and American eating habits.
3. Students should be able to read at the college level.
4. When possible, students using this lesson should be apprised of the special characteristics of this instructive method and admonished to follow instructions precisely – to respond and to use the *Answer Booklet* as directed. For maximum effectiveness, the lesson should be followed up as soon as possible with actual field experience.

Results of Field Tryouts – see inside back cover

FOOD-BORNE DISEASE INVESTIGATION: ANALYSIS OF FIELD DATA

An Instructive Communication



U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
COMMUNICABLE DISEASE CENTER
Atlanta, Georgia 30333

A TRAINING BRANCH PUBLICATION

TECHNICAL ADVISERS

John H. Ackerman, M. D., *Assistant Chief*
Training Branch

Richard F. Clapp, *Chief*
Community Services Training Section

TRAINING METHODS DEVELOPMENT SECTION

INSTRUCTIVE COMMUNICATIONS UNIT

Robert L. Reynolds, *Chief*

Frances H. Porcher, *Editor*

Thomas F. Gilbert, Ph. D., *Special Consultant*

Public Health Service Publication No. 1186

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON: 1964

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C., 20402 - Price 40 cents

CONTENTS

HOW TO USE THIS LESSON	<i>page</i> 1
SALMONELLOSIS INVESTIGATION	
Introduction	2
Investigation Procedures	3
Constructing and Interpreting the Attack Rate Table	8
Determining Median Onset Time and Probable Meal	13
Using the Inductive Process	18
STAPHYLOCOCCAL FOOD POISONING	
Introduction	23
Investigating a Staphylococcal Epidemic	23
TERMINOLOGY	27
REMEDIAL EXERCISE ON MEDIANS AND GRAPHS	32

read carefully

HOW TO USE THIS LESSON

1. In this lesson you will learn by actually using the techniques and procedures being presented. If you read carefully and perform the simple operations as you are instructed, you will seldom give an incorrect answer. You will need only this booklet and a pencil. The lesson will require from one-and-a-half to two-and-a-half hours to complete.
2. Take each page and section as it comes. *Master each step before moving on.*
3. Make any computations (and other notes) in the margins.
4. Before leaving a page, CHECK and CORRECT the answers you have given. If you make an error, be sure you know *why*.
5. Answers are provided in a special *Answer Booklet* inserted in the front of this booklet. Throughout the lesson, avoid looking at an answer until you have given your own. Use the *Answer Booklet* to check and correct *all* your answers as you finish each page.

If you have not already taken the *Answer Booklet* out, take it out NOW.

SALMONELLOSIS INVESTIGATION

INTRODUCTION

Diarrhea and abdominal cramps are the dominant symptoms in *Salmonella* (pronounced: Sal-mo-nel-la) gastroenteritis (salmonellosis). They are usually accompanied by vomiting, chills, and fever. Salmonellosis is milder than most forms of bacterial diarrhea, and the stool is usually not bloody. The illness usually runs its course in three days.

The causative agents are several varieties of *Salmonella* bacteria. They are found in the intestines of almost *all* poultry and hogs. If the human ingests salmonellae in *sufficient quantity*, he usually gets sick in about 18 hours (12-to-24 hours is the range).

Salmonellae are transmitted in animal food products, or by certain other foods that come in *contact* with them. Salmonellae are also transmitted by infected humans who do not wash their hands well after a bowel movement, and who then handle food. Any food that contains salmonellae is *contaminated*, but these bacteria grow only in certain *vulnerable foods*. When salmonellae increase to such quantities as to make people sick, the host food is said to be an *infective food*.

Salmonellosis is rarely fatal except in elderly people. It is commonly found in homes where food is not handled properly, and Public Health agencies have done very little to prevent these cases. However, by applying proper sanitary operating procedures, an *outbreak* of salmonellosis can be controlled in a place where food is prepared for public consumption. Procedures taught in this lesson can be used in investigating other forms of food-borne disease.

*In this lesson the term "vulnerable" is synonymous with "potentially hazardous" in PHS Publication No. 934.

INVESTIGATION PROCEDURES

READ THIS CAREFULLY, BUT DO NOT TRY TO MEMORIZE ANY PART OF IT.
CHECK EACH PARAGRAPH WHEN YOU HAVE READ IT CAREFULLY ENOUGH TO UNDERSTAND.

- _____ 1. A salmonellosis epidemic is first suspected when cases of diarrhea are reported to the local health department. These reports most often are made by private physicians and institutional authorities, although they may come from laboratories and individuals. The symptoms described are frequently typical enough to suggest the presence of a strain of *Salmonella*.
- _____ 2. A public health worker interviews all suspected cases, and he seeks information that would uncover other cases not reported.
- _____ 3. He then finds the average time of the *onset* (beginning) of the symptoms. Since it takes from 12-to-24 hours, or an average of 18, for salmonellae to incubate, he subtracts to find the time he suspects the infective food was eaten.
- _____ 4. Next, he questions patients to see *where* they ate at the *suspected eating time*. They will usually have eaten at one particular place.
- _____ 5. He then computes the percentage of sick people that ate each food served at that time. He compares this with the percentage of sick people that did *not* eat each food. A *high percentage* of sick people *will* have eaten the infective food and a markedly *lower percentage*, if any, *will not* have eaten the infective food.
- _____ 6. If he cannot find a common eating place at the suspected eating time, he tries to discover some other common source of food by examining other ways in which the patients are alike. For example, if the patients are all businessmen, they may have eaten the same cheese dip at a cocktail party.
- _____ 7. The whole purpose of the investigation is to discover the infective food so that the source of infection or method of contamination can be understood and additional cases and future outbreaks prevented. The exercises that follow will teach you how to analyze the field data in such an investigation.
- _____ 8. A final diagnosis of salmonellosis must be confirmed by laboratory tests.

Food is *INFECTIVE* when it contains *enough* *infectious* organisms to make a person sick (*INFECTED*). Food can become *INFECTIVE* only

- if* (1) it is *VULNERABLE* (able to support growth of infectious organisms),
and (2) it gets *CONTAMINATED* (some infectious organisms get into or on it),
and (3) its *TEMPERATURE* is right (for growing infectious organisms),
for (4) adequate *TIME* (from when it gets contaminated to when it is eaten)
for it to grow *enough* organisms to make it *INFECTIVE*.

SALMONELLAE are infectious organisms, but they can make food *INFECTIVE* only

- if* (1) the food is *VULNERABLE* Typically, vulnerable foods are *moist* and have a *high protein* content. Some vulnerable foods: cheese, beans, meat, eggs, dairy products. (*Pickled* foods and *dry* breads are *not* vulnerable.)
and (2) it gets *CONTAMINATED* Salmonellae must get into it or on it.
and (3) its *TEMPERATURE* is right Anywhere *between 45°F.* and *115°F.*
for (4) adequate *TIME* Organisms multiply enough in *4 hours.*

Salmonellae – as shown above – multiply at *TEMPERATURES* ranging from *45°F.* to *115°F.* Approximately four hours is adequate *TIME* for the organisms to multiply enough to make a contaminated food *INFECTIVE*. Now, look at what happens to salmonellae at temperatures *outside* that temperature range:

ABOVE 140°F. Heat kills salmonellae in approximately 12 minutes.

“Proper cooking” means heating foods to temperatures above 140°F. for at least 12 minutes.

BELOW 45°F. Salmonellae do not multiply (i.e., contaminated food will *not become* infective);

“Refrigerating” means cooling and then keeping foods colder than 45°F.

- but cold does not kill salmonellae (i.e., infective food *will remain* infective);
and when allowed to warm, the organisms will multiply.

Look at each SITUATION described below and show (by filling in the blanks or scratching out the unnecessary words) what CONCLUSION you would draw. Refer to the information on page 4 if necessary.

SITUATION	CONCLUSION
1. Vulnerable food got contaminated with salmonellae and the organisms multiplied enough to make the food infective.	The organism had been in the food for _____ hours at least, at a temperature of between _____°F. and _____°F. during that time.
2. Vulnerable food contaminated with salmonellae was put into a refrigerator one hour after becoming contaminated. In 30 minutes the temperature of the food was below 45°F.	After it had been in the refrigerator 2½ hours, the food WOULD/WOULD NOT (scratch one) be safe for immediate eating. After seven hours in the refrigerator, the food WOULD/WOULD NOT be safe for immediate eating.
3. Food that had gotten contaminated was allowed to stand at room temperature (65° to 75°F.) for five hours.	This food is almost certain to have become _____, but only if it were a _____ food.
4. Food that had become infective was put in a refrigerator.	After several hours, this food WOULD/WOULD NOT be safe to eat.
5. Food that had become infective was put on the kitchen table and left.	Properly cooking this food later WOULD/WOULD NOT make it safe to eat.
6. Food known to be infective was boiled for 15 minutes and then put in the refrigerator and left for nine hours.	This food, when taken from the refrigerator, WOULD/WOULD NOT be safe for immediate eating. This food, six hours after being taken from the refrigerator, WOULD/WOULD NOT be safe to eat if not re-contaminated.

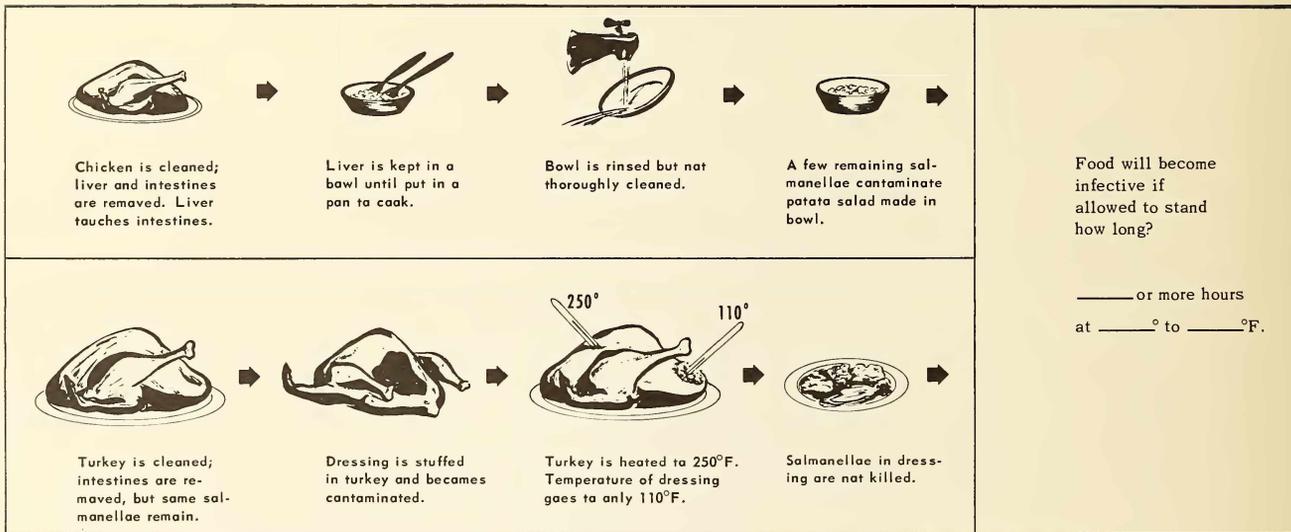
Check (✓) the VULNERABLE foods below—remember salmonellae are most likely to grow and multiply in *moist, high protein* foods.

- | | | | | |
|---------------------|----------------------|--------------------|----------------------------|-----------------|
| _____ chicken salad | _____ coffee | _____ potato salad | _____ celery | _____ turkey |
| _____ milk | _____ cottage cheese | _____ sliced bread | _____ pickled pigs' feet | _____ eggnog |
| _____ custard | _____ pork | _____ oranges | _____ carbonated beverages | _____ hamburger |

REMEMBER TO LOOK AT THE ANSWER BOOKLET
CHECK AND CORRECT YOUR ANSWERS

Salmonellae normally live in the intestines of POULTRY and HOGS and get into a few poultry eggs before they are laid. When any vulnerable food contacts or contains gut products of hogs or poultry, or eggs, it can become contaminated and grow infective quantities of *Salmonella* organisms.

TYPICAL MEANS OF CONTAMINATION AND BACTERIAL GROWTH TO INFECTIVE STATE



Check the vulnerable foods below. Remember: vulnerable foods are moist, high protein foods; vinegar and other acids kill *Salmonella* organisms or prevent growth and multiplication.

- | | | | |
|-------------|-----------------------|--------------------|--------------------------|
| _____ liver | _____ oysters | _____ baked potato | _____ milk |
| _____ pork | _____ potato salad | _____ pickled eggs | _____ French bread |
| _____ duck | _____ chicken gizzard | _____ sausage | _____ pickled pigs' feet |

DID YOU REMOVE THE *ANSWER BOOKLET* FROM THE FRONT OF THIS BOOK, AND HAVE YOU CHECKED AND CORRECTED YOUR ANSWERS ON PAGE 6? IF NOT, DO IT NOW.

Check the foods below from which there is a reasonable possibility that a person would get salmonellosis. Remember that pork and poultry products are *always* suspect.

- _____ 1. Stuffed *turkey* cooked at low temperature for a short time.
- _____ 2. A piece of chicken liver accidentally got into a jar of pickles two days before the *pickles* were eaten.
- _____ 3. *Milk* that picked up a few salmonellae from dirty hands and after 5 hours was put in the refrigerator and allowed to stand for 24 hours at 38°F.
- _____ 4. An infected baker rinsed his hands lightly after a bowel movement and then handled confectionery cream to make *cream puffs*; these were left in a warm display cabinet for six hours.
- _____ 5. *Salmon* patties prepared by clean hands.
- _____ 6. Rare *pork* prepared by clean hands.
- _____ 7. Rare *chicken livers* prepared by clean hands.
- _____ 8. Rare *sirloin steak* prepared by clean hands.

CONSTRUCTING AND INTERPRETING THE ATTACK RATE TABLE

Shown below is an ATTACK RATE TABLE prepared as an aid in identifying infective foods. It lists the *vulnerable* foods served to 110 persons at a banquet; it is assumed that one or more of the foods might be infective. Once the ATTACK RATE TABLE is prepared, it is used as follows:

1. For each food listed, find the percentage of those who *did eat* the particular food and later got sick. Look in this column
2. Then compare the percentage just located with the % of those who *did not eat* the particular food but got sick anyway. Look in this column

ATTACK RATE TABLE								
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
baked ham	19	56	75	25%	30	5	35	86%
custard	45	15	60	75%	4	46	50	8%
jello	20	35	55	36%	29	26	55	53%
cole slaw	48	58	106	45%	1	3	4	25%
baked beans	45	55	100	45%	4	6	10	40%
potato salad	25	45	70	36%	24	16	40	60%

3. The infective food will show the *greatest difference* between the two attack-rate percentages. Note that the *larger* of the two percentages of the infective food *MUST always* be in the FIRST percentage column.

The probable infective food as indicated by the ATTACK RATE TABLE is _____ . NOTE: Laboratory examination of the suspected infective food is necessary for final confirmation of the finding in the TABLE.

When an outbreak occurs, the public health worker interviews both the sick and the well persons who ate the meal suspected of having caused salmonellosis. He asks them what foods they ate, and he enters the information he gets from them on a case-history questionnaire.

From the questionnaires he prepares a SUMMARY TABLE something like the one shown on the right (tables can vary in form). He puts a check mark (\checkmark) for each person, sick or well, who DID EAT the particular food; he puts an X-mark if the person questioned did NOT eat the food.

Now, look at the SUMMARY TABLE and answer these questions:

How many sick persons *did* eat (\checkmark) turkey? _____

How many well persons did *not* (X) eat peas? _____

The total numbers of sick and well persons who did eat and those who did not eat the various foods are taken from the SUMMARY TABLE and used to construct an ATTACK RATE TABLE.

NOW YOU DO THIS: In the ATTACK RATE TABLE already started, compute the percentage of all the sick persons who did eat each food. For example, of the 57 persons who ate turkey, 49 got sick. Divide 49 by 57; this gives .859 or .86; .86 multiplied by 100 gives the attack rate percentage of 86%. This one has been done for you—you make the computations and complete the column in the TABLE.

NOW YOU DO THIS: Compute the attack rate percentage of sick persons who did *not* eat each food. Enter the percentages in the appropriate column.

The infective food will have the *greatest difference* between its two percentages. Remember that the higher of the two percentages must be for those who *did eat* the food.

The probable infective food is _____.

SUMMARY TABLE

Sick Persons						Well Persons					
Person	turkey	peas	cheese salad	milk	custard	Person	turkey	peas	cheese salad	milk	custard
S 1	✓	✓	✓	✓	X	W 1	X	✓	✓	✓	✓
S 2	X	✓	X	✓	X	W 2	✓	X	✓	X	✓
S 3	✓	✓	✓	X	✓	W 3	X	✓	✓	✓	X
S 4	✓	X	✓	X	X	W 4	✓	X	X	✓	✓
S 5	X	✓	✓	✓	✓	W 5	X	✓	✓	X	✓
S 6	✓	X	✓	X	X	W 6	✓	✓	X	X	✓
S 7	✓	✓	✓	✓	X	W 7	✓	X	✓	✓	✓
S 8	✓	X	✓	X	✓	W 8	X	✓	✓	✓	X

ATTACK RATE TABLE

Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
turkey	49	8	57	86%	3	40	43	
peas	16	24	40		36	24	60	
cheese salad	50	46	96		2	2	4	
milk	36	20	56		16	28	44	
custard	22	45	67		30	3	33	

SUMMARY TABLE

Person	beef stew	macaroni	cream pie
S 1	X	√	√
S 2	√	√	√
S 3	√	X	√
S 4	X	√	X
S 5	X	√	√
S 6	√	√	√
S 7	X	√	√
S 8	√	X	√
S 9	X	√	√
S 10	X	√	√

*S 1, S 2, etc., are
the sick persons*

W 1	√	√	√
W 2	√	X	√
W 3	√	X	X
W 4	X	X	√
W 5	√	X	√
W 6	X	√	√
W 7	√	X	√
W 8	√	X	√
W 9	√	X	√
W 10	√	X	√

*W 1, W 2, etc., are
the well persons*

Total 20 Persons

On the left is a SUMMARY TABLE prepared by a public health worker. This is a case where 20 persons ate at a business luncheon, and 10 of them later had diarrhea suspected of being salmonellosis.

Using the SUMMARY TABLE, you prepare an ATTACK RATE TABLE and compute the *attack rate percentages*.

REMEMBER: A "√" indicates that the food being considered *was* eaten by the person.

An "X" indicates that the food being considered *was not* eaten by the person.

ATTACK RATE TABLE								
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %

Notice that a total here added to its corresponding total here will equal the total number of persons here. Use this to check your work.

According to the findings of the ATTACK RATE TABLE, the infective food is

Salmonellae usually take about 18 hours to make a person sick. If the median time at which patients got sick was 6:30 AM, January 2, 1962, you would suspect that the infective food was consumed 18 hours earlier, or around _____ (PM/AM) the day before. Therefore, a reasonable assumption is that the infected persons ate lunch at the same place on January 1, 1962.

When we have computed the SUSPECTED EATING TIME we question the patients and find out *where* they ate at that time. Usually we find some one place where they all ate a meal. Then we bring them a menu from that establishment to find out *what vulnerable foods they ate*. We do this because we can't trust the patient's memory/honesty (underline the better answer).

Next, we must find others who ate the suspected meal, but who did *not* get sick. We also interview them to find out what _____ foods they ate.

If a food is infective, two things *must* be true:

1. A *large* percentage of those who got sick *did eat* the food.
2. A *small* percentage (if any) of those who got sick did *not* eat the food. Actually, they may not remember exactly what they ate, or their sickness may have come from something entirely different.

This information is gotten from case histories taken from both the sick and well who ate at or from a common place of exposure (party, bakery, etc.). The information is summarized on a form like the one on the left—CASE HISTORIES AND SUMMARY TABLE. The common place of exposure indicated by the table shown on this page is _____.

Now, *you* find the SUMMARY TABLE and use it to prepare an ATTACK RATE TABLE and complete the analysis.

ATTACK RATE TABLE

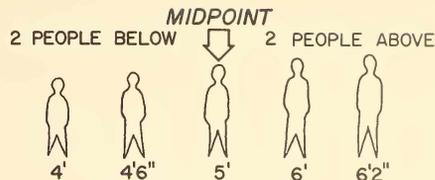
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %

The probable infective food is _____

DETERMINING MEDIAN ONSET TIME AND PROBABLE MEAL

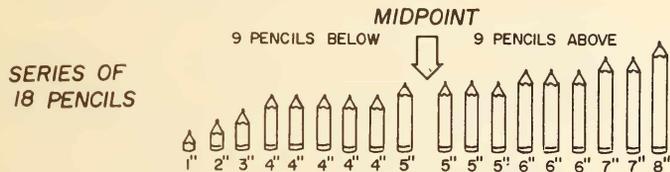
The **MEDIAN**, like all averages, is a measure of central tendency; it is the midpoint of a series of ordered values. If there are five people whose heights are 4', 4'6", 5', 6', and 6'2", the midpoint of the ordered series is 5'; therefore the median height is 5'. This can be illustrated this way

**SERIES OF
5 PEOPLE**

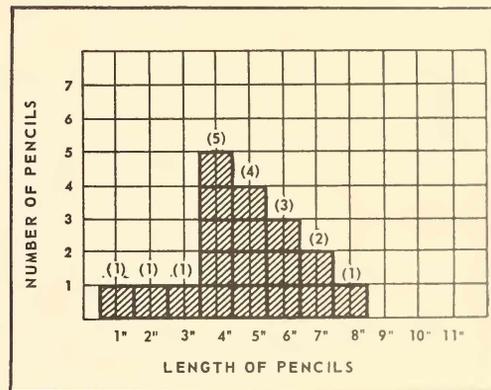
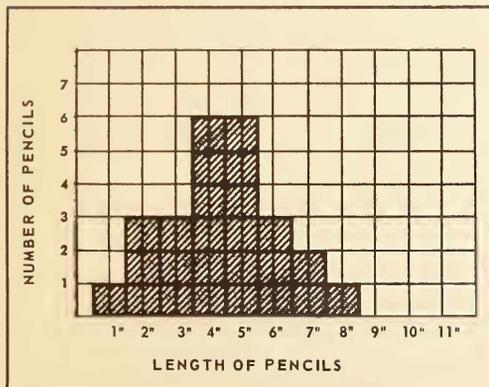


The graph on the right shows that in a group of old pencils one is 1" long, one is 2" long, etc. There are 18 pencils; count them (add numbers in parentheses)

The drawing illustrates the midpoint of 18:



We see that the midpoint falls between the ninth and tenth pencils. Since both are 5" long, the median is 5". All this information is on the graph — you find it there



IF YOU DO NOT UNDERSTAND HOW TO FIND THE MEDIAN AND READ A GRAPH, TURN TO PAGE 32.

◀ Look at the graph on the left. There are 25 pencils, and the midpoint of 25 is 13. Find the thirteenth pencil *in order of length*; the median length is _____

CHECK AND CORRECT YOUR ANSWER

Eleven cases of salmonellosis-like diarrhea are reported. The public health worker interviews all persons involved, plots a graph of the onset times of symptoms, and determines the MEDIAN ONSET TIME. Making a graph is important because in more advanced epidemiology—beyond the scope of this lesson—the shape of the “epidemic curve” is a valuable source of information.

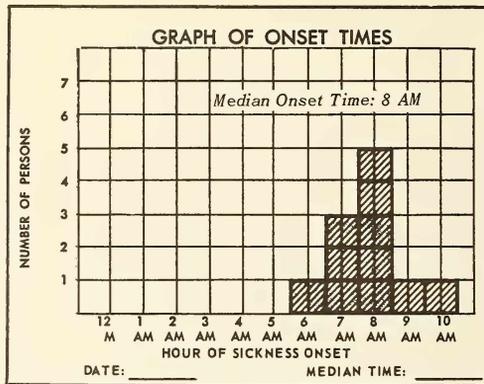
a. According to the graph how many persons became sick at 7 AM? _____

b. The median onset time is shown to be _____.

c. The suspected eating time can be found by subtracting 18 hours from the median onset time and is _____ AM/PM.

d. Therefore the probable meal (breakfast, lunch, or supper) is _____

on Jan. _____.



e. Complete the appropriate form to complete the analysis.

The probable infective food is _____.

ATTACK RATE TABLE								
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
milk	10	8	18	56%	1	1	2	50%
hamburger	9	2	11	82%	2	7	9	22%
hot dogs								

CASE HISTORIES AND SUMMARY TABLE

Place of exposure (establishment, etc.):

Joe's Snack Bar

Date of outbreak: 1/3/62

Person	Sick (yes or no)	Eating time (date and hour)		Date and hour of sickness onset	Vulnerable Foods		
					milk	hamburger	hot dogs
S 1	yes	1/2	1 PM	1/3 7 AM	√	√	X
S 2	yes	1/2	1 PM	1/3 8 AM	√	√	X
S 3	yes	1/2	12 N	1/3 7 AM	√	√	X
S 4	yes	1/2	2 PM	1/3 8 AM	√	√	X
S 5	yes	1/2	11 AM	1/3 6 AM	√	X	√
S 6	yes	1/2	1 PM	1/3 7 AM	X	√	X
S 7	yes	1/2	2 PM	1/3 8 AM	√	√	X
S 8	yes	1/2	2 PM	1/3 9 AM	√	X	√
S 9	yes	1/2	3 PM	1/3 10 AM	√	√	X
S 10	yes	1/2	2 PM	1/3 8 AM	√	√	X
S 11	yes	1/2	1 PM	1/3 8 AM	√	√	X
W 1	no	1/2	2 PM		√	X	√
W 2	no	1/2	5 PM		√	X	√
W 3	no	1/2	5 PM		√	X	√
W 4	no	1/2	3 PM		√	X	√
W 5	no	1/2	3 PM		X	√	X
W 6	no	1/2	5 PM		√	√	X
W 7	no	1/2	1 PM		√	X	√
W 8	no	1/2	4 PM		√	X	√
W 9	no	1/2	2 PM		√	X	√

TOTAL 20 PERSONS

Twelve patrolmen living in a state-police barracks have been reported sick with diarrhea resembling salmonellosis. The public health worker gets a case history on each patient. (He also collects a stool specimen for laboratory verification of the tentative diagnosis of salmonellosis.) He plots a graph of their onset times.

a. Use the data in the CASE HISTORIES AND SUMMARY TABLE here to plot the GRAPH OF ONSET TIMES here

b. The median onset time is _____.

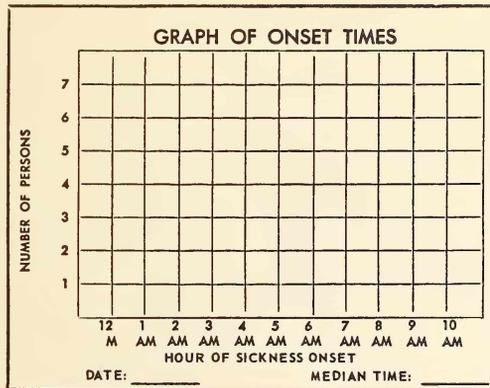
c. The probable meal is (check one): _____ breakfast

_____ lunch

_____ supper

Date: _____

d. Complete the analysis, using all the proper forms. The probable infective food is _____.



ATTACK RATE TABLE								
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
corn beef	3	2	5	60%	9	6	15	60%
pudding	8	1	9	89%	4	7	11	36%
pork & beans								

CASE HISTORIES AND SUMMARY TABLE

Place of exposure (establishment, etc.): Inst. Kitchen St. Police Barracks							
Date of outbreak: 2/8/62						Vulnerable Foods	
Person	Sick (yes or no)	Eating time (date and hour)	Date and hour of sickness onset	corn beef	pudding		
S 1	yes	2/7 12 N	2/8 6 AM	X	√	√	
S 2	yes	2/7 11 AM	2/8 4 AM	X	X	√	
S 3	yes	2/7 1 PM	2/8 7 AM	X	√	√	
S 4	yes	2/7 12 N	2/8 7 AM	X	√	X	
S 5	yes	2/7 12 N	2/8 6 AM	√	X	√	
S 6	yes	2/7 11 AM	2/8 5 AM	X	X	√	
S 7	yes	2/7 1 PM	2/8 7 AM	X	√	√	
S 8	yes	2/7 11 AM	2/8 6 AM	X	X	√	
S 9	yes	2/7 1 PM	2/8 8 AM	√	√	√	
S10	yes	2/7 12 N	2/8 7 AM	X	√	√	
S11	yes	2/7 1 PM	2/8 7 AM	√	√	X	
S12	yes	2/7 1 PM	2/8 8 AM	X	√	√	
W 1	no	2/7 11 AM		X	X	√	
W 2	no	2/7 11 AM		X	X	√	
W 3	no	2/7 11 AM		√	√	X	
W 4	no	2/7 12 N		X	X	√	
W 5	no	2/7 1 PM		X	X	√	
W 6	no	2/7 1 PM		√	X	√	
W 7	no	2/7 12 N		X	X	√	
W 8	no	2/7 12 N		X	X	√	

TOTAL 20 PERSONS

Twelve women are suspected of having salmonellosis. They are all interviewed, and the time of onset of diarrhea is noted.

a. Plot the graph of the onset times.

b. The probable meal is (check):

_____ breakfast

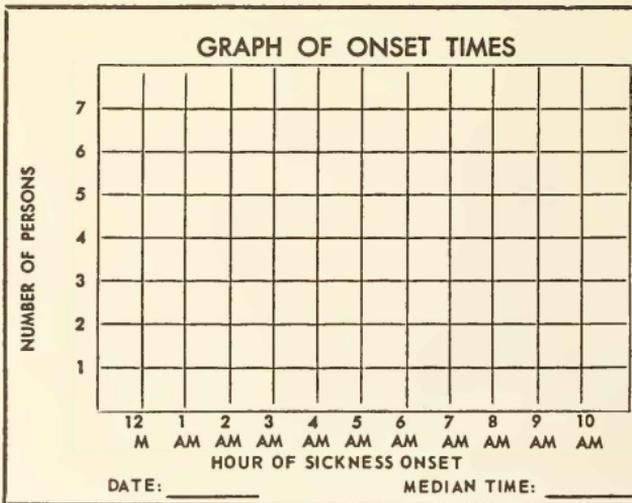
_____ lunch

_____ supper

Date: _____

c. When you know the suspected eating time and probable meal, you then interview the patients to find where they ate at that time. In this case they ate at (where?)

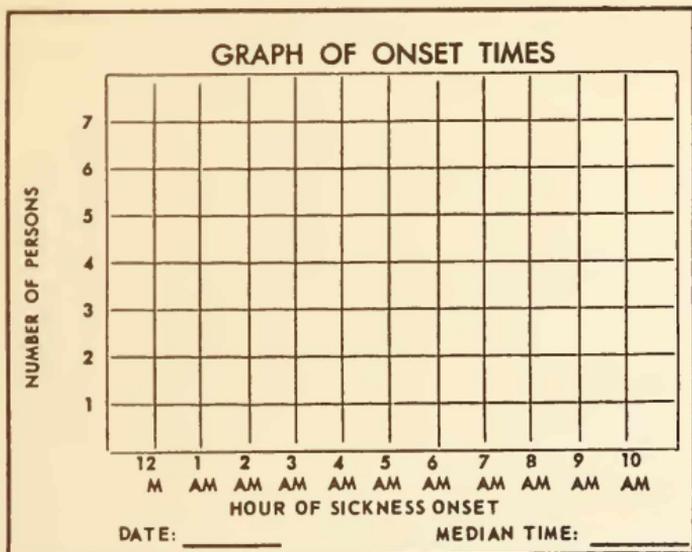
d. Complete the analysis. The probable infective food is



ATTACK RATE TABLE								
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
cream pie	10	1	11	91%	2	7	9	22%
cheese dip	3	2	5	60%	9	6	15	60%
cream cheese sandwich	8	2	10	80%	4	6	10	40%

Eleven children are reported sick. Use the materials and information furnished to find the probable infective food.

- The infective food is _____.
- The probable meal is _____ on _____.
- The infective food was eaten at (where?) _____.



ATTACK RATE TABLE								
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
chicken	3	2	5	60%	8	7	15	53%
potato salad	7	3	10	70%	4	6	10	40%
pecan pie	10	4	14	71%	1	5	6	17%

USING THE INDUCTIVE PROCESS

Sometimes case histories do not make it obvious that infected persons ate at the same place. When this happens, the public health worker must apply all he knows about each patient to discover where the infective food came from. He goes through the *inductive process* to piece together small, seemingly unrelated *known* facts, such as age, sex, religion, occupation, etc., to arrive at the *unknown* – the place of exposure. The process is illustrated in the four examples that follow:

Example One. Thirty persons are reported sick, but case histories do not show a common eating place for breakfast, lunch or supper. The public health worker makes a distribution chart of the patients by age and sex.

DISTRIBUTION CHART: AGE & SEX OF PATIENTS

		SEX	
		Male	Female
AGE	1-3		
	4-6		
	7-9		
	10-12		
	13-15		
	16-18		
	over 18		

The chart shows that all patients are women or children. The public health worker reasons that it is likely that the patients ate the infective food at a party, possibly a birthday party for one of the children, since they are all about the same age.

He then returns to his patients and discovers that they attended the same party at about the suspected eating time. He finds out what vulnerable foods were served, makes a **SUMMARY TABLE**, and identifies the infective food.

Given below are the reasoning and conclusions of the public health worker before he reached his final conclusion in the case of the 30 women and children just considered. He is asking, "What is a likely place of exposure for these persons, whose homes are scattered across the city?" Examine his reasoning and put a check mark (✓) beside each statement that seems reasonable to you. If all seem reasonable, check all of them.

REASONING: _____ If bakery, dairy, or canned goods had been bought and eaten in separate homes, children of other ages and men would probably also have eaten those foods.

CONCLUSION: The patients ate at the same place, not in their separate homes.

REASONING: _____ Patients would probably report having eaten in a public restaurant.

_____ If a restaurant were the place of exposure, men and children of other ages would also have eaten the infective food and been reported sick.

CONCLUSION: The infective food did *not* come from a public restaurant.

REASONING: _____ It is rare for such a group, composed of persons living in separate homes, to be fed exclusively by an institution. This possibility will be investigated when better possibilities have been ruled out.

CONCLUSION: The infective food probably did *not* come from an institutional kitchen.

REASONING: _____ Women and children sometimes gather for parties and group functions and eat something other than a meal.

_____ The ages of the children suggest a birthday party.

CONCLUSION: The patients ate the infective food at a private party.

When the most reasonable conclusion has been reached, the public health worker returns to the patients to verify his conclusion and begin the procedure of making an attack rate analysis.

DON'T FORGET
CHECK AND CORRECT YOUR ANSWERS

Example Two: Forty cases of what seems to be salmonellosis are reported among people living in various parts of the city. The histories reveal no common eating place at the suspected eating time. The public health worker looks for some other trait common to most of the group.

FINDINGS: Of the persons reporting sick, 62% work in the kitchen and dining room of a local hospital, but they have their meals at home. Most of the rest of the sick are members of the hospital group's immediate families. However, no hospital patients or other personnel became sick.

Check the one conclusion that seems most reasonable:

- a. The infective food was probably eaten at the hospital.
- b. Contaminated food not yet in the infective state could have been taken home and on the way it could have grown a dangerous salmonella concentration (become infective) before it was refrigerated again.
- c. The patients probably got the food at a public restaurant.

From the best conclusion above it seems likely that the food came from what place (check one below)?

- public restaurant
- private banquet
- the institutional (hospital) kitchen
- dairy (home delivery)
- bakery (home delivery)

Example Three: Fifteen women came down with salmonellosis. All of them reported having eaten their regular meals in their own homes during the period in which they might have eaten the infective food. The public health worker finds these things to be true about the patients:

- a. They are all adult women.
- b. They are all Jewish.
- c. They are all housewives.

He concludes that the women were probably infected by food that came from what place (check one below)?

- public restaurant
- private party or club meeting
- dairy (home delivery)
- bakery (home delivery)
- institutional kitchen
- private banquet

Example Four: Twelve cases are reported, and all the patients ate their regular meals at home during the 12-to-24-hour incubation time. Below are data collected on them. Examine the data.

PERSON	SEX	RACE	RELIG.	OCCUPA'N	AGE
S 1	M	W	Prot.	student	14
S 2	M	W	Cath.	student	14
S 3	M	W	Prot.	student	12
S 4	M	W	Jew	student	13
S 5	M	W	Prot.	student	13
S 6	M	W	Prot.	student	13
S 7	M	W	Prot.	preacher	26
S 8	M	W	Prot.	student	14
S 9	M	W	Prot.	student	12
S 10	M	W	Cath.	student	13
S 11	M	W	Prot.	student	14
S 12	M	W	none	student	13

Check the place that the patients probably got infected:

_____ public restaurant

_____ banquet

_____ party or meeting

_____ institutional kitchen

_____ dairy

_____ bakery

STAPHYLOCOCCAL FOOD POISONING

INTRODUCTION

READ FOR UNDERSTANDING

Some types of staphylococci are even more common causes of food-borne disease than are the salmonellae. The symptoms produced by the two bacteria are similar: both induce nausea, vomiting, and diarrhea. However, there are characteristic differences:

	DISTINGUISHING SYMPTOMS		
	<u>onset</u>	<u>fever</u>	<u>duration</u>
<i>Staphylococcal poisoning</i>	abrupt with severe prostration	no fever	24 hours
<i>Salmonellosis</i>	gradual with less severe prostration	with fever	72 hours

Unlike salmonellae, staphylococci are not normally classed as intestinal organisms, but thrive in the mucous areas of the human nose and mouth, on the skin, in pimples, in skin lesions and under the fingernails. In protein foods handled by a carrier of the food-poisoning types, the organisms will grow to dangerous quantities in four or more hours, depending on the temperature.

Also unlike *Salmonella*, the *Staphylococcus* organism does not infect man directly. Rather, it produces an enterotoxin (a poison affecting the gastrointestinal tract) that causes the symptoms. The enterotoxin is *thermostable*, that is, it is not destroyed by heat. Therefore cooking food in which the toxin has been formed will *not* make it safe. Any food that contains staphylococcal enterotoxin must be destroyed.

INVESTIGATING A STAPHYLOCOCCAL EPIDEMIC

The procedures for collecting and analyzing field data in a staphylococcal food-borne epidemic are virtually the same as for salmonellosis. A notable difference is in the incubation time of the two diseases—in staphylococcal poisoning there is a 2-to-8-hour incubation time, the median being about 3 hours. Therefore the suspected eating time is usually the most recent meal.

The table below shows the characteristics of *Salmonella* and *Staphylococcus* as food-borne pathogens. Study the table carefully and note the differences and similarities. Then answer the questions below.

BACTERIA	CHIEF SOURCES	MULTIPLIES	CAUSATIVE AGENT	INCUBATION TIME	DESTRUCTION OF CAUSATIVE AGENT
SALMONELLAE	POULTRY & HOGS	 MOSTLY IN HIGH PROTEIN FOODS in 4 or more HOURS at 45-to-115°F	DIRECTLY BY SALMONELLA ORGANISMS	12 to 24 HOURS AVG: 18 HOURS	TEMPERATURE ABOVE 140°
STAPHYLOCOCCI	HUMAN NOSE, MOUTH, NAILS, PIMPLES, etc. <i>also</i> COWS		AN ENTEROTOXIN PRODUCED BY STAPHYLOCOCCI	2 to 8 HOURS AVG: 3 HOURS	NONE! HEAT CANNOT DESTROY THE ENTEROTOXIN. COOKING DOES NOT HELP.

- Which bacteria can be transmitted to food by sneezing? _____
- If you boiled milk containing enterotoxin produced by staphylococci, would the milk then be safe? _____
- If the median outbreak time of the disease was 5 PM, what would be the suspected eating time if the causative agent was staphylococcal enterotoxin?

- Is celery a vulnerable food for staphylococcal enterotoxin? _____
- Which bacteria thrive under fingernails? _____
- Fever is more characteristic of salmonellae/staphylococci. (scratch one)
- Severe prostration is more characteristic of the disease produced by salmonellae/staphylococci. (scratch one)

Complete the table below.

BACTERIA	CHIEF SOURCES	MULTIPLIES	CAUSATIVE AGENT	INCUBATION TIME	DESTRUCTION OF CAUSATIVE AGENT
SALMONELLAE	POULTRY & HOGS	 MOSTLY IN HIGH PROTEIN FOODS in _____ or more HOURS at _____° to _____°F.	DIRECTLY BY SALMONELLA ORGANISMS	____ to ____ HOURS AVG: _____ HOURS	TEMPERATURE ABOVE _____°F.
STAPH _____	HUMAN NOSE, MOUTH, NAILS, PIMPLES, etc. <i>also</i> COWS		AN ENTERO _____ PRODUCED BY STAPHYLOCOCCI	____ to ____ HOURS AVG: _____ HOURS	NONE! THE ENTEROTOXIN IS THERMOSTABLE

Read the completed table to make sure you understand it before you answer the questions.

- Which bacteria thrive in the nose of humans? _____
- Which pathogen would be more likely to be found in unpasteurized milk?

- When milk has been made toxic by staphylococcal enterotoxin, will pasteurizing make it safe for drinking? _____
- If an outbreak of staphylococcal food poisoning occurred at noon, what would be the probable meal? _____
- Fever is more characteristic of which disease? _____
- Severe prostration is more characteristic of which disease? _____

Complete the table below.

BACTERIA	CHIEF SOURCES	MULTIPLIES	CAUSATIVE AGENT	INCUBATION TIME	DESTRUCTION OF CAUSATIVE AGENT
SALMONELLAE	POULTRY & HOGS	 MOSTLY IN HIGH PROTEIN FOODS in ____ or more HOURS at ____° to ____°F.	DIRECTLY BY SALMONELLA ORGANISMS	____ to ____ HOURS AVG: ____ HOURS	_____ _____
			AN _____	____ to ____ HOURS AVG: ____ HOURS	_____

 CHECK AND CORRECT YOUR ANSWERS

TERMINOLOGY

In the three brief exercises that follow, you will review the terms used in this lesson. Read the definitions carefully. As you read, relate the terms to what you now know about epidemiological procedures.

1. **Onset:** The beginning of the symptoms of sickness.
2. **Suspected Eating Time:** The day and hour suspected of being the time that the infective or toxic food was eaten.
3. **Attack Rate:** A rate (percentage) arrived at by dividing the total number of persons exposed to risk into the total number that got sick.
4. **Vulnerable Food:** Moist, high protein food liable to grow salmonellae or staphylococci. (Also called *potentially hazardous food*.)
5. **Salmonellae:** The bacteria causing salmonellosis. (Remember how to spell it.)
6. **Summary Table:** A count of the sick and well persons who ate (and did *not* eat) each of the vulnerable foods.
7. **Contaminated Food:** A food that contains bacteria, but not necessarily enough to make a person sick.
8. **Infective Food:** A food that is contaminated with bacteria (e.g., salmonellae) which have grown to sufficient quantities to make a person sick.
9. **Toxic Food:** A food that contains an enterotoxin (produced by bacteria, e.g., staphylococci) that causes food poisoning.
10. **Incubation Period:** The time it takes (e.g., 12-to-24 hours for salmonellosis) for disease to manifest itself after infective or toxic food is ingested.
11. **Staphylococcus:** A bacterium, a strain of which produces an enterotoxin which in turn causes a food-borne gastroenteritis.
12. **Enterotoxin:** A poisonous (toxic) substance which is produced in vulnerable foods by some strains of *Staphylococcus*.

In the blanks provided write the appropriate terms answers have been given to help you.

1. The bacteria causing salmonellosis:
2. A count of the sick and well persons who ate (and did *not* eat) each of the vulnerable foods:
3. Bacteria that produce a 24-hour gastroenteritis characterized by severe prostration, nausea, and vomiting, but no fever:
4. The time it takes (e.g., 12-to-24 hours for salmonellosis) for a disease to manifest itself after the infective or toxic food is ingested:
5. The beginning of the symptoms of sickness:
6. A food that contains bacteria (e.g., salmonellae) which have grown to sufficient quantities to make a person sick:
7. The day and hour suspected of being the time the infective or toxic food was eaten:
8. The percentage arrived at by dividing the number of persons exposed to risk into the number of persons that got sick:
9. A toxic substance produced by staphylococci:
10. Moist, high protein food liable to grow salmonellae or staphylococci:
11. A food that contains bacteria, but not necessarily enough to make a person sick:
12. A food that contains an enterotoxin:

for the definitions. Partial

(check spelling)

_____ table

_____ period

_____ food

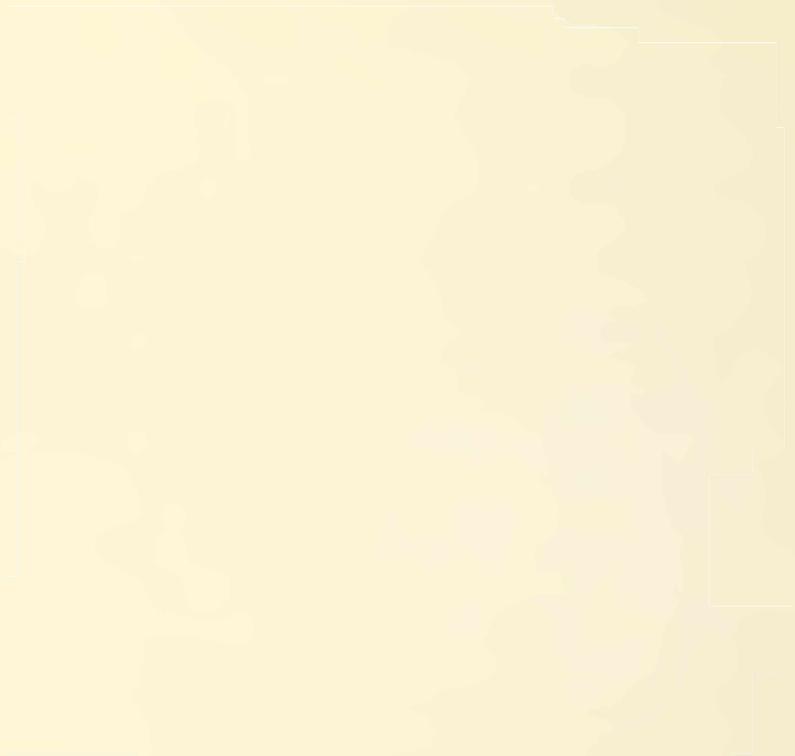
_____ time

_____ rate

_____ food

_____ food

_____ food



In the blanks provided, write the appropriate terms for the definitions. You're on your own this time.

1. A food that contains bacteria, but not necessarily enough to make a person sick: _____
2. The percentage arrived at by dividing the number of persons exposed to risk into the number that got sick: _____
3. A food that contains bacteria (e.g., salmonellae) which have grown to sufficient quantities to make a person sick: _____
4. The beginning of the symptoms of sickness: _____
5. A count of the sick and well persons who ate (and did not eat) each of the vulnerable foods: _____
6. The time it takes (e.g., 12-to-24 hours for salmonellosis) for a disease to manifest itself after the infective or toxic food is ingested: _____
7. A food that contains an enterotoxin: _____
8. The day and hour suspected of being the time the infective or toxic food was eaten: _____
9. Moist, high protein food liable to grow salmonellae or staphylococci: _____
10. The organisms that cause salmonellosis: _____
11. Bacteria that cause gastroenteritis by secreting a toxic substance: _____
12. The toxic agent secreted by this organism: _____

THE END

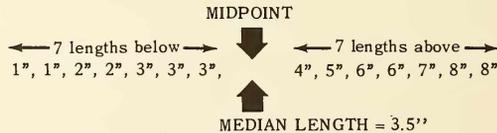
REMEDIAL EXERCISE ON MEDIANS AND GRAPHS

If you have a list of numbers or measures, the **MEDIAN** is the one that falls in the middle when they are put in a series. Though similar to the mean, the **MEDIAN** is not exactly the same as the mean (or what is commonly referred to as the "average").

To find the **MEDIAN** you must first arrange the numbers or measures in sequence; for example, from small to large. Look at this list of 14 lengths:

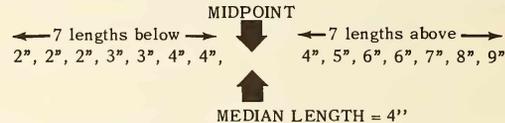
In random order: 3", 6", 8", 7", 6", 8", 5", 2", 4", 3", 1", 2", 1", 3"

The same lengths arranged in a "series of ordered values" becomes:



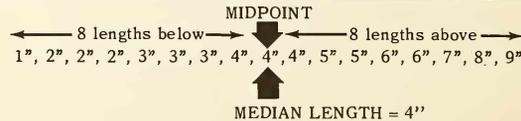
Notice that the middle value – or **MIDPOINT** – is between 3" and 4"; therefore the median length is 3.5"

Another random list of 14 lengths has been arranged in sequence.



Notice that the **MIDPOINT** falls between 4" and 4"; therefore the median length is 4". (NOTE: It is *not* 4.5")

These 17 lengths have been put in sequence:



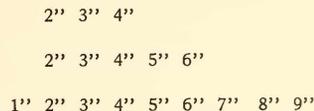
The midpoint is *exactly* on 4"; therefore the median length is 4".

CONTINUE ON NEXT PAGE

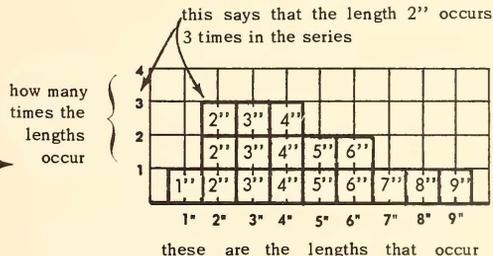
A series of ordered values can also be shown in the form of a graph. Take, for example, the last list of 17 lengths (repeated here)



When the lengths that are alike are "stacked" on top of each other, the list looks like this

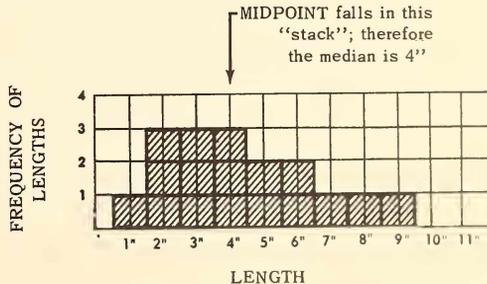


Now, add a few lines and headings to the lengths arranged in "stacks," and you have a graph like this



A more finished version of the same graphic representation is shown here

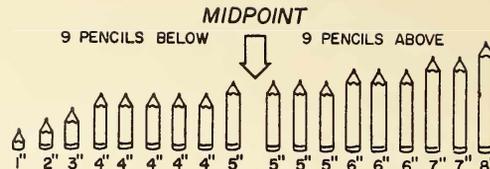
Notice that you can still find the midpoint and median by either "counting the blocks" in order of occurrence or adding together the frequency of occurrence of each of the lengths.



CONTINUE ON NEXT PAGE

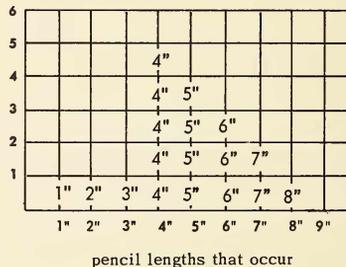
Now, let's consider the graph on page 13 that apparently gave you trouble.

The series of 18 pencils (in sequence from shortest to longest) is repeated here

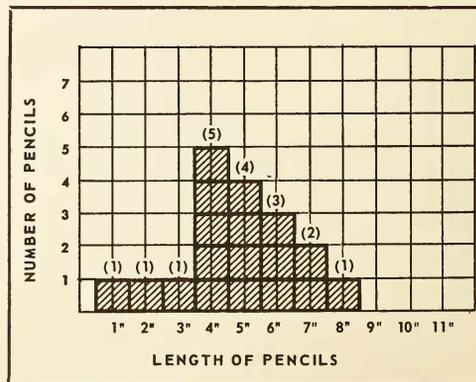


Again, by stacking the various pencil lengths that are alike, we will get a rough graph like this one

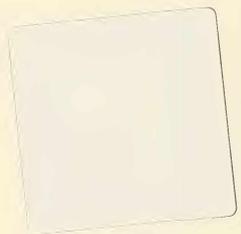
how many times each pencil length occurs



This is the more familiar version of the graph as it appears on page 13; you should now be able to use it to find that the midpoint falls between the ninth and tenth pencils and that the median is therefore 5' - the length of both those pencils



RETURN TO P. 13 - COMPLETE THE EXERCISE



ANSWER BOOKLET

FOR

FOOD-BORNE DISEASE INVESTIGATION: ANALYSIS OF FIELD DATA

An Instructive Communication

Examine this *Answer Booklet* carefully before you begin the lesson, then put it aside. You should check all your work (as you finish each page) against the correct answers in this booklet. Correct any mistakes made.

ANSWERS--PAGE 5

1. 4 hours; between 45 ° F. and 115 ° F.
2. WOULD be safe; WOULD be safe
3. infective; vulnerable food
(NOTE: food becomes infectiveu; people become infectedu)
4. WOULD NOT be safe
5. WOULD make it safe
6. WOULD be safe; WOULD be safe

- | | | |
|---|--|---|
| <input checked="" type="checkbox"/> chicken salad | <input checked="" type="checkbox"/> cottage cheese | <input checked="" type="checkbox"/> turkey |
| <input checked="" type="checkbox"/> milk | <input checked="" type="checkbox"/> pork | <input checked="" type="checkbox"/> eggnog |
| <input checked="" type="checkbox"/> custard | <input checked="" type="checkbox"/> potato salad | <input checked="" type="checkbox"/> hamburger |

If you made errors, go back and study page 4.

ANSWERS--PAGE 6

4 or more hours at 45 ° to 115 °F.

- | | | | |
|---|---|---|---|
| <input checked="" type="checkbox"/> liver | <input checked="" type="checkbox"/> duck | <input checked="" type="checkbox"/> potato salad | <input checked="" type="checkbox"/> sausage |
| <input checked="" type="checkbox"/> pork | <input checked="" type="checkbox"/> oysters | <input checked="" type="checkbox"/> chicken gizzard | <input checked="" type="checkbox"/> milk |

ANSWERS--PAGE 7

1. 3. 4. 6. 7.

ANSWERS--PAGE 8

The probable infective food is custard

ANSWERS--PAGE 9

6 sick persons did eat turkey.

3 well persons did *not* eat peas.

The probable infective food is turkey

ATTACK RATE TABLE								
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
turkey	49	8	57	86%	3	40	43	7%
peas	16	24	40	40%	36	24	60	60%
cheese salad	50	46	96	52%	2	2	4	50%
milk	36	20	56	64%	16	28	44	36%
custard	22	45	67	33%	30	3	33	91%

ANSWERS--PAGE 10

ATTACK RATE TABLE								
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
<i>beef stew</i>	4	8	12	33%	6	2	8	75%
<i>macaroni</i>	8	2	10	80%	2	8	10	20%
<i>cream pie</i>	9	9	18	50%	1	1	2	50%

The probable infective food is macaroni

ANSWERS--PAGE 11

The infective food was consumed (eaten) at around 12:30 PM

We can't trust the patient's memory

Interview to find out what vulnerable foods they ate

ANSWERS--PAGE 12

The common place of exposure is Acme Bakery

Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
<i>eclair</i>	2	3	5	40%	9	6	15	60%
<i>cream puff</i>	4	7	11	36%	7	2	9	78%
<i>cheese cake</i>	9	2	11	82%	2	7	9	22%

The probable infective food is cheese cake

ANSWERS--PAGE 13

The midpoint is the 13th pencil; this pencil is 4" long; therefore, the median length is 4".

If you answered incorrectly, go to page 32 and study the remedial exercises (again if necessary, and especially the last example on page 32).

ANSWERS--PAGE 14

a. 3

b. 8 AM

c. 2 PM

d. lunch

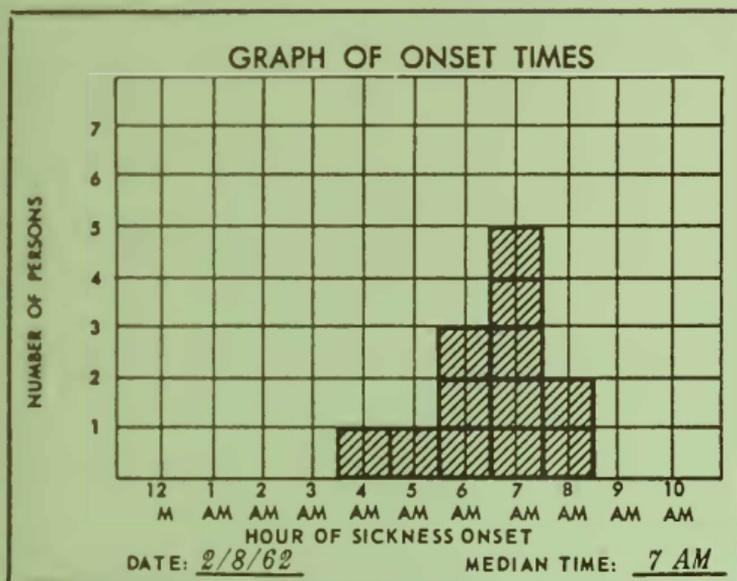
on Jan. 2, 1962

e. hamburger

ATTACK RATE TABLE

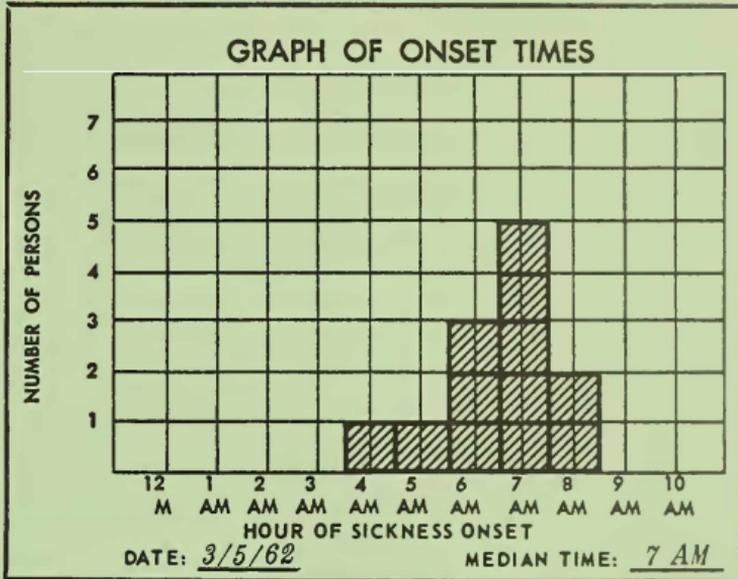
Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
milk	10	8	18	56%	1	1	2	50%
hamburger	9	2	11	82%	2	7	9	22%
hot dogs	2	7	9	22%	9	2	11	82%

a.

b. 7 AMc. lunchDATE: 2/7/62d. pudding**ATTACK RATE TABLE**

Vulnerable Food	Persons Who DID EAT Vulnerable Food				Persons Who Did NOT Eat Vulnerable Food			
	Sick	Well	Total	Attack Rate %	Sick	Well	Total	Attack Rate %
corn beef	3	2	5	60%	9	6	15	60%
pudding	8	1	9	89%	4	7	11	36%
pork & beans	10	7	17	59%	2	1	3	67%

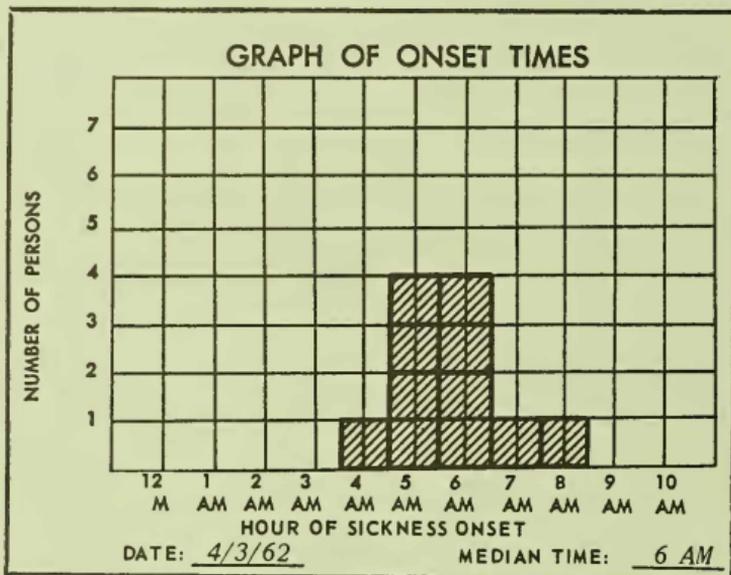
a.



- b. Probable meal: lunch on 3/4/62
- c. Place: woman's club meeting in a home
- d. Probable infective food is cream pie

ANSWERS--PAGE 17

- a. The infective food is pecan pie
- b. The probable meal is lunch on 4/2/62
- c. Eaten at child's birthday party



ANSWERS--PAGE 19

The reasoning is good for every conclusion reached. You should have checked all the blanks.

ANSWERS--PAGE 20

- b. (This is the best conclusion under the circumstances.)
- the institutional kitchen

ANSWERS--PAGE 21

✓ private party or club meeting

EXPLANATION: 1. Group has no persons of non-Jewish denominations and no men or children--rule out public restaurant.

2. No other members of family (husband, children) got sick--rule out home deliveries from dairy and bakery.
3. All regular meals were eaten at home--rule out private banquet or institutional kitchen, both of which usually serve meals.

ANSWERS--PAGE 22

✓ party or meeting

EXPLANATION: 1. All regular meals were eaten at home--rule out public restaurant, banquet, institutional kitchen.

2. No one else in family got sick--rule out home dairy and bakery deliveries.

ANSWERS--PAGE 24

1. staphylococci
2. no
3. 2PM
4. no
5. staphylococci
6. salmonella
7. staphylococci

ANSWERS--PAGE 25

Check your table by the one on page 24 of the lesson.

1. staphylococci
2. staphylococcus
3. no
4. breakfast
5. salmonellosis
6. staphylococcal
7. food poisoning

BACTERIA	CHIEF SOURCES	MULTIPLIES	CAUSATIVE AGENT	INCUBATION TIME	DESTRUCTION OF CAUSATIVE AGENT
SALMONELLAE	POULTRY & HOGS	 MOSTLY IN HIGH PROTEIN FOODS in <u>4</u> or more HOURS at <u>45° to 115°</u> F.	DIRECTLY BY SALMONELLA ORGANISMS	<u>12</u> to <u>24</u> HOURS AVG: <u>18</u> HOURS	<u>TEMPERATURE</u> <u>ABOVE 140°F</u>
STAPHYLOCOCCI	HUMAN NOSE, MOUTH, NAILS, PIMPLES, etc. also COWS		AN <u>ENTEROTOXIN</u>	<u>2</u> to <u>8</u> HOURS AVG: <u>3</u> HOURS	<u>NONE</u>

ANSWERS--PAGE 29

- salmonellae
- summary table
- staphylococci
- incubation period
- onset
- infective food
- suspected eating time
- attack rate
- enterotoxin
- vulnerable food
- contaminated food
- toxic food

ANSWERS--PAGE 31

- contaminated food
- attack rate
- infective food
- onset
- summary table
- incubation period
- toxic food
- suspected eating time
- vulnerable food
- salmonellae
- staphylococci
- enterotoxin

